Metro Bike Share Infographic Web Design

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Abstract. This project is a map-based data visualization website to help the metro bike shareholders analyze bike usage performance. The map information shows the bike fleet information by stations and has various types of charts presenting potential factors that influence bike usage. The modern website and data visualization technologies we used included Angular, Bootstrap, d3, Mapbox, etc.

Keywords: Metro bike share · Data Visualization · D3.

1 Introduction

1.1 Motivation

Metro bike share, the Los Angeles bicycle sharing system, aims to provide commuters a new way to make connections between the metro stations and get around the city. Yet, even for one of the busiest areas, downtown Los Angeles, the bicycles only see an average of 0.7 rides a day *Pasadena Quit.* `https://www.latimes.com/local/lanow/la-me-ln-pasadena-bike-share-20180904-story.html`. [Online; Accessed 06-December-2019]. 2018." The shareholders of the metro bike share were aware of this problem and took quick actions. They pulled Pasadena out of the plan in July 2018 due to the very low rides data, and in early 2019, they expanded the service into North Hollywood *LA Metro North Hollywood.* `https://la.curbed.com/2019/2/27/18243591/metro-los-angeles-bike-share-westside-ciclavia`. [Online; Accessed 06-December-2019]. 2019. It is a genies business strategy to give up the low demand stations and relocate the bikes to the potential busy areas, especially with a limited budget. For this business strategy, shareholders need more geologic data and insight to make decisions.

1.2 Differential Advantage

Different from the existing data projects which focus on the overall analysis such as trips by times, bike types or user behavior, our project mainly focuses on showing data insight by each station, geologically. Our target audience is the shareholder who are curious about the station data. "Which stations are high-demanded that we need to place more bikes?" "Where are the areas that we should shut down?" "Why?" Our project helps them answer all these questions by providing our map-based visualization platform.

2 Data

2.1 Dataset

We retrieved three datasets from the LA Bike Share Metro Website *Bike share data.* `https://bikeshare.metro.net/about/data/`. [Online; Accessed 06-December-2019]. 2019. For different charts, we combined and linked the dataset by Python to generate the new dataset. Then we converted them to JSON format for further analysis in JavaSript.

Trip Data This is the major dataset we use. The data has been refined according to years. We select the trip data from 2017 Q1 to 2019 Q3. To generate the map, we also linked it with the other two datasets: [Station Table] and [Station Status].

Station Table The Station dataset has five features: Station ID (Unique integer that identifies the station), Station Name, Go live date, Region (includes DTLA, Pasadena, Port of LA, Venice) and Status ("Active" or "Inactive").

Station Status This is a real-time data showing station location and status information which is available to both GeoJSON format and GBFS format.

3 Approach

3.1 Design Flow

The welcome page has two components that are interactive to each other. The left part shows who we are and what this project is about. According to the "Z pattern" theory *Black back*. `https://www.creativebloq.com/web-design/design-jargon-explained-z-pattern-71515717`. [Online; Accessed 06-December-2019]. 2012, people look at a website starting from the left. So we place the introduction part here to help users know "what this website is about" quickly. Here is a start where users can interact with our website. By hovering the text, users can see a change of the map on the right side. The right part is the second component showing a Los Angeles map with the station locations. Here, users are encouraged to click the station group, which will link to the analysis page. For example, if the user clicks the "Downtown LA" dot here, the analysis page will show up and the center of the map is "Downtown LA". This is a smooth flow to lead the user from the welcome page to the visualization page.

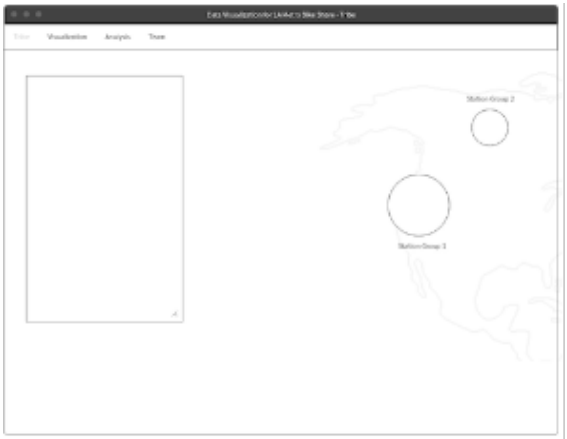

Fig. 1. Welcome Page

The visualization page is the most important page of the website which has two parts. The left part is a station map. We set the center of the map in the 1/3 width of the screen and keep the station dot in the center. When users click the station dot, the right part pops up showing all the information related to this one specific station. We follow the funnel theory D. Rose. *The information-seeking funnel. In National Science Foundation workshop on Information-Seeking Support Systems*. 2008 to make our information starts from simple real-time data to station data by years, and ends with more detailed information including data by hours and destination information.

Fig. 2. Visualization Page

If the users are curious to learn more information and further insight. They can dive into a big-picture analysis on our "Analysis" page where we provide insights about passholder type, ride duration, and bike type analysis by years.

3.2 Color Consideration

We use black as the main color of the website, which is also the background color of the map. "Hot pink plus dark blue on the black background made the map hard to read if you're trying to find out where things

are." *Black background 2*. https://spatialityblog.com/2012/07/27/nyc-stop-frisk-cartographic-observations/. [Online; Accessed 06-December-2019]. 2012. However, the project we build is not a traditional map that aims to let the user find where the stations are. The black background is tested to successfully standout the items especially when the content is not too much. *Black background 3*. https://dev.to/neshaz/how-and-when-to-create-a-website-with-a-black-background-design-2a3e. [Online; Accessed 06-December-2019]. 2012 It is even more visible to use a black background for smaller elements to point them out to another color. Second, we keep the color consistent in the entire website to create a smooth color flow for the users. Finally, for the components which have text more than image and charts, we change the background transparent to make the texts more readable. For the colors for the charts and dots, we follow the blue and green color palette[8]. We also make a slight change for the line chart to make it extinguishable.

3.3 Form Consideration

To show charts by time unit, we select a time series chart to show the high/low peaks and demand/supply as time goes by. For station related charts, we choose to use the dot map to show the locations of all stations and also add the secret sauce on each dot which is filling the dot with the percentage of availability.

3.4 Technical Consideration

Angular is used to build the framework. We used Angular router to Bind the router to links on a page so it will navigate to the appropriate application view. A data service is created to pass values between sibling components as well.

Python and R are used to process our LA metro bike data to support rendering the different types of charts in different formats.

Bootstrap is used to construct our application's responsive layout, which allows our website can automatically adjust the layout based on different screen dimensions.

D3 is used to render our statistic charts and LA map.

Mapbox is mainly used to show our bike station locations.

3.5 Development and Evaluation

Unit Test For each component, ensure the data pipeline goes well to show the result, test whether each chart displays correctly and supports interactive actions with users.

Integration Test Test whether navigation menu items navigate to the corresponding appropriate component view. Inspect the initialization state and rendering the web page in different conditions.

4 System

Fig. 1. Station data by years, Bike station shows top 5 destinations and Total trips by Hour of the Day When users hover on the station, the right-side panel will automatically show a dashboard showing Station trips by years(bar chart), Top 5 Destinations (bar chart) and the total number of trips hourly of the current station (line series chart).

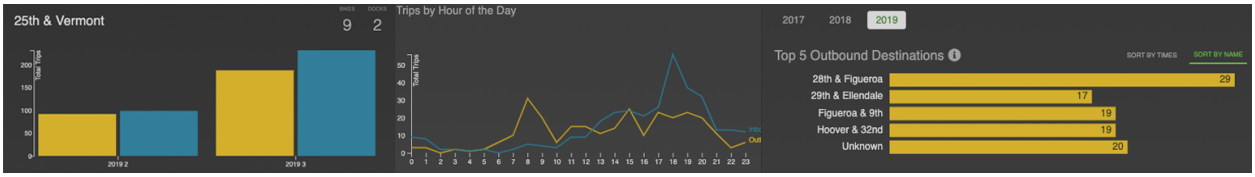

Fig. 1. Station data by years, Bike station shows top 5 destinations and Total trips by Hour of the Day

Fig. 2. Bike Station Inbound and Outbound We also want to see each station's inbound and outbound, which allows us to see where people, who rent the bikes, come from and head to which stations. The chart will be able users to select a specific station and years to show the circle packing layout of inbound and outbound stations. This is a circle packing layout implemented by d3.js. It is responsive, interactive and has d3 animated transitions.

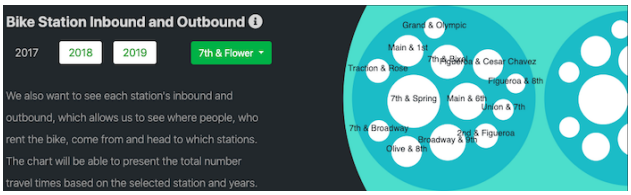

Fig. 2. Bike Station Inbound and Outbound

Fig. 3. Bike Type Usage Growth This is a group Bar Chart implemented by d3.js. It will automatically adjust the size based on the screen size (responsive chart). It is also interactive and it has d3 animated transitions.

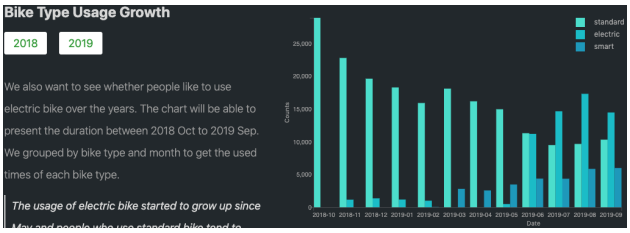

Fig. 3. Bike Type Usage Growth

Fig. 4. Ride Duration By Passholder Type This chart shows the average ride duration of each passholder type, which includes Flex Pass, Monthly Pass, Walk-up, One Day Pass and Annual Pass. This is a line chart implemented by d3.js. It will automatically adjust the size based on the screen size (responsive chart). It supports well visual queries: years, click legend to toggle visibility of specific placeholder type (interactive chart). It animates the chart and axis when data changes (d3 animated transitions)

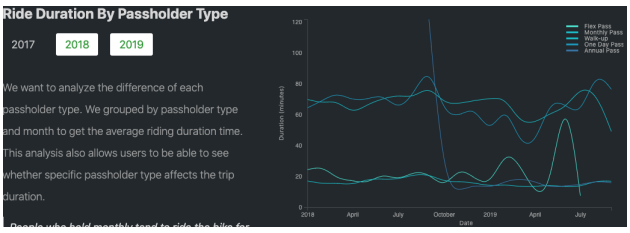

Fig. 4. Ride Duration By Passholder Type

5 Related work

Our research mainly focus on understanding the already existing visualizations on LA Metro Bikeshare performance and digging into the aspects that we wanted to improve on such that the shareholders can make a quick and informed decision on the bike renew system or other business strategies.

LA Bike Data Analysis *Research 1.* `https://geog594.wordpress.com/visualization/`. [Online; Accessed 06-December-2019]. 2018 Most of the LA bike data analysis projects we see are not very user interactive. In order to make our website more interactive, we did the following changes. For layout and visual design, our first query shows "where" these stations are, therefore the users will first land on a dot map showing all stations. If the users need more details "when" for one particular station, they might intuitively hover/click on the station, so a panel will pop up from the right to respond to the users' actions and show more details. We also add on the tooltip to optimize the user experience and make them understand the charts in a better way.

LA Bike Data Official *Research 2.* `https://bikeshare.metro.net/stations/`. [Online; Accessed 06-December-2019]. 2019 The official data website shows limited information. We added a lot of features to give people more original insight for the bike data. First, we have a real-time share bike availability. This data shows the percentage of metro share bikes in the station and helps the management team to refill the bikes if the percentage of availability is too low. Second, we creatively add the "Top 5 destinations" for each metro bike share station. This data provides insights on relations between bike stations and could help adjust the price or free-ride strategy.

6 Conclusions

The website we created is responsive and interactive data roadmap. It encourages users to deep into the insight themselves. We also follow the data analysis logic to help users to find and solve their problems related to the station data easily. We also have three ideas for future improvements. First, we can analyze whether users' gender and age will be factors that affect them using metro bikes. Second, we can see whether people use metro bikes more often on holidays or weekdays. Third, we can do more research on LA weather data/temperature and see whether this feature will affect people using metro bikes.

References

Bike share data. `https://bikeshare.metro.net/about/data/`. [Online; Accessed 06-December-2019]. 2019.

Black back. `https://www.creativebloq.com/web-design/design-jargon-explained-z-pattern-71515717`. [Online; Accessed 06-December-2019]. 2012.

Black background 2. `https://spatialityblog.com/2012/07/27/nyc-stop-frisk-cartographic-observations/`. [Online; Accessed 06-December-2019]. 2012.

Black background 3. `https://dev.to/neshaz/how-and-when-to-create-a-website-with-a-black-background-design-2a3e`. [Online; Accessed 06-December-2019]. 2012.

LA Metro North Hollywood. `https://la.curbed.com/2019/2/27/18243591/metro-los-angeles-bike-share-westside-ciclavia`. [Online; Accessed 06-December-2019]. 2019.

Pasadena Quit. `https://www.latimes.com/local/lanow/la-me-ln-pasadena-bike-share-20180904-story.html`. [Online; Accessed 06-December-2019]. 2018.

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